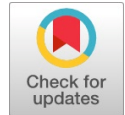# Organizational Ergonomics: Human Engineering Leading To Employee Well-Being

K. Gomathi, Rajini.G

Abstract: Human engineering is the application of mental health and physiological principles to the structure of products, procedures, and schemes. The aim of human engineering is to decrease human mistake, improve productivity level, and increase safety and well-being with a particular focus on the association between the human and the thing of intrigue. Practicing good ergonomics leads to increased productivity, improved health and safety of workers, higher job satisfaction and retention of employees. Sampling technique is probability, multistage sampling , sampling units garment companies, The multiple regression analysis was used to study the relationship between the factors influencing ergonomics, resilience, subjective and objective well-being. This study was conducted in India's Textile hub of Garment industry: Tiruppur District, Tamilnadu state. The data was collected from 453 garment industry employees through a structured questionnaire. The finding of this study organisational ergonomics, resilience, subjective well-being and objective well-being has strongly depends on physical workplace environment and machines. Task, but doesn't have an effect of psychosocial factor. Subjective well-being strongly depends on Task, Organisational ergonomics, Resilience. Objective well-being is depends on organisational ergonomics. Proper workplace environment and good condition machinery creates better comfortable and safe workplace which leads to employee well-being. Human engineering factors (Physical workplace environment, Machines, Task, and Psychosocial Factor) facilitated by organisational ergonomics leads to a better employee well-being.

KEYWORDS: Human engineering, Organizational Ergonomics, Resilience, Objective Well-being, Subjective Well-being, Textile industry.

I. INTRODUCTION

Human components is the logical order worried about the comprehension of collaborations among people and other fundamentals of a organisation, and the profession that applies ethics, theory information and techniques to configuration to enhance human well-being and general framework execution. A human factor is engaged to satisfy the goals of work related well-being and safety and profitability. It is relevant in the design of such things as protected furnishings and simple to utilize interfaces to machines and tools (IEA).

Organisational ergonomics takes a shot at complete improvement of the work environment directly from quality administration to cooperation. It incorporates overseeing everything in the association to make it a improved place.

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Previous research exhibited the term of ergonomics is made from the Greek two words "ergo" implies (work) and "nomos" implies (laws).

Actually, ergonomics truly signifies "the laws of work" (Murrell, 1971; Sluchak, 1992). (Chapanis, 1985; Sanders and McCormick, 1987) Ergonomics defined as human elements, is concern and finds information about human behaviour, restriction, capacities, and different qualities to the structure of machines, instruments, tasks, frameworks, job and working environment for safe, gainful, comfortable, and effective human use. Today, the logical control of ergonomics can be separated into three types which are physical, organisational and cognitive ergonomics. Physical ergonomics manages anthropometric and physiologic parts of job structure. In another study, cognitive ergonomics looks at human psychological procedures, for example, apperception, response and coordination data handling. (Karwowski and Rodrick (2002)).

James (1987), this study found that the most significant work environment stress elements are the measure of command over a person's own capacities. Nonetheless, different factors, for example, the colleagues and supervisor; work environment condition, job conflict, work timetable may likewise prompt work environment stress. Earlier studies have predict that, nearly manufacturing job condition can prompt work environment, yet depend on workers response to it. There are not many criteria of work illness that nearly purpose worry for workers which incorporates time due dates, work over-burden, deprived relationship among superintendent, machine paced task, monotonous work, absence of control, cognitive demand, job uncertainty and physical condition. (Rafaeli, 1987 and Sutton).

The poor ergonomics factors workstation condition is the fundamental supporter of the work stress issues (Makhbul and Idrus, 2009). Work Overload pressure can bring about poor impacts and ready to influence a specialist's psychological or physical well-being and even affect their work execution. In long run, it directly influences organization's performance (Boswell, 2006).

Safer (2011) The studies shows that after execution of ergonomics in the organisation performer work simpler and keeps your work force healthy. The examination is stressed on employees' views on nature of employment, workplace environment and their present work postures at work. It translates that employees of Puducherry manufacturing concerns are given best workplace however they additionally stand up to with works including vibrations and standing sitting postures for longer length. It reveals that employees are reasonably satisfied with the present ergonomics at their work place.

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Eklund (1995) study found that poor ergonomic work environment was related with enthusiastic stress and physical, just as low profitability and lesser quality of work. This was especially valid for labours who at the industrial enterprises.

At this point, ergonomic arrangements must definitely be made, for the garment sector is based on a labor-intensive structure. The primary goal of the assessment of the workplace environment as far as ergonomic perspectives isn't just to guarantee wellbeing and security of the employees but also create a workplace for them where they can initiate viably their physical qualities and physiological and mental capacities. In this way, it is conceivable to expand the proficiency of the employees and the nature of the work. In this manner, it will be conceivable to build the adequacy of the employees and the nature of the work done as is determined in the studies of (Hassal et al(2015))

A. Objectives of The Study

- To find out the relationship between the factors influencing Ergonomics, Resilience, Subjective Well-being and Objective Well-being.

II. RESEARCH METHODOLOGY

A. Introduction

Research methodology is a way to systematically solve the research problem. Kothari (2004)

B. Research Design

This research is descriptive research that the analyse the dependency between independent variable and dependent variable through quantitative approach. Using survey method the data were collected in the area of Tiruppur which is hub of garment industry around.

C. Sampling and population

A total of 550 samples targeted and only 453 finished and useable. According to Hair (2006) that the sample size is too large or small may have a negative impact on the statistical result. This study focus on garment industry employees who is not working contract based. Hair JF (2007) Multi-stage sample testing includes a grouping of stages. First stage is to choose the random sample of the whole district in bunch. The subsequent stage is to choose a particular region and at concluding stage to choose applicable items for test size.

D. Instrument and measurement

Structured questionnaire used as an instrument to gather the primary data. The questionnaire was designed based on prior related literature (D.S.Padmini, 2013;Zafir Mohd Makhbul, 2011;Oya Erdil,2011;Mark A.Blais, 1999; Giovanni Costa,2006)

E. Data collection

Primary data were collected through structured questionnaire. The survey questionnaire were distributed to Garment industry employees Tirupur : India's Knit Wear Capital. Secondary data was collected in form of literature reviewed from various nationwide and worldwide journals, websites, manuscripts, online databases and reports.

F. Data analysis

SPSS 22 version used to enter and analyse the data. Multiple Regressions is used when we need to predict the value of a variable dependent on the value of at least two different variables. The variable we want to predict is called the dependent or outcome variable. The factors we are using to predict the value of the dependent variable are called the independent or explanatory variables.

III. ANALYSIS AND FINDINGS

A. Multiple Regression Analysis

Is used to find the linear combinations of independent variables that correlate maximally with the dependent variable.

The author used multiple regression model again (Rajini.G. 2011) to find the combination of the effects of the independent variables (Physical workplace environment X_1, Machines X_2, Task X_3, Psychosocial environment X_4) against the dependent variable (Subjective Well-being, objective well-being).

$$Y_{1a} = C_{1a} + b_{1a}X_1 + b_{2a}X_2 + b_{3a}X_3 + b_{4a}X_4$$

The regression was tested by using T-test and the coefficient was used to compare as well as determine the percentage of variation that exist in the dependent variable. F –value was used to know the significance of the F distribution.

H_1: Organisational ergonomics does not depend on Physical workplace environment, Machines, Task, Psychosocial factor.

The first hypothesis, the dependent variable is Organisational ergonomics on the independent variables are Physical workplace environment(X_1), Machines(X_2), Task(X_3), Psychosocial factor(X_4).

$$Y_1 = C_1+A_{1a}X_1+A_{1b}X_2+A_{1c}X_3+A_{1d}X_4$$

Where c_1 is constant, A_{1a}, A_{1b}, A_{1c}, A_{1d} are regression coefficients. Thus the regression coefficients were executed.

Table-1 Model summary- Physical workplace environment, Machines, Task, Psychosocial factor and Organisational ergonomics

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.556ᵃ	.309	.304	.33737
a. Predictors: (Constant), PSF, PWE, Machines, TASK				

From the above Table provides inference that the ability of prediction for model was articulated by R value 0.556 and R^2value 0.309 which shows 30.9% of variance exist in the dependent variable is from the independent variables. F-value is 70.671 showing that there exists a relationship between PWE, Machines, Task, PSF with Organisational Ergonomics

Table- 2 ANOVA- Physical workplace environment, Machines, Task, Psychosocial factor and Organisational ergonomics

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	32.175	4	8.044	70.671	.000ᵇ
	Residual	72.049	633	0.114		
	Total	104.224	637			
a. Dependent Variable: Organizational Ergonomics						
b. Predictors: (Constant), PSF, PWE, Machines, TASK						

Source: Primary Data

Table-3 Coefficients- Physical workplace environment, Machines, Task, Psychosocial factor and Organisational ergonomics

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		

(Constant)	2.177	.214		10.188	.000
PWE	.296	.072	.235	4.137	.000
Machines	.255	.044	.261	5.731	.000
TASK	.065	.036	.098	1.786	.075
PSF	-.213	.026	-.287	-8.294	.000
a. Dependent Variable: Organizational Ergonomics					

Source: Primary Data From the above table it is inferred that the beta value is 0.296 for variable 1(Physical workplace environment) and 0.255 for variable 2 (Machine) and 0.065 for variable 3 (Task) and -0.213 for variable 4 (Psychosocial factors) There is a significant relationship between Physical workplace environment and Organizational Ergonomics (P value = .000). There is a significant relationship between Machines and Organizational Ergonomics (P value = .000). There is a significant relationship between Psychosocial factors and Organizational Ergonomics (P value = .000). Which is <0.05. There is no significant relationship found Task and Organizational Ergonomics since the P value is >0.05 which is .075. Thereby the final regression equation is derived by the incorporating the coefficients as follows

> Organisational Ergonomics=2.177+**.296(Physical workplace environment) + .255(Machine)**+0.065(Task)**-.213 Psychosocial factors.**

H₂: Resilience does not depend on physical workplace environment, Machines, Task, Psychosocial factor.

The Second hypothesis, the dependent variable is Resilience on the independent variables are Physical workplace environment(X_1), Machines(X_2), Task(X_3), Psychosocial factor(X_4).

$Y_2 = C_2 + A_{2a}X_1 + A_{2b}X_2 + A_{2c}X_3 + A_{2d}X_4$

Where c_2 is constant, A_{2a}, A_{2b}, A_{2c}, A_{2d} are regression coefficients. Thus the regression coefficients were executed.

Table-4 Model summary- Physical workplace environment, Machines, Task, Psychosocial factor and Resilience

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.594ª	.353	.349	.32619
a. Predictors: (Constant), PSF, PWE, Machines, TASK				

Source: Primary Data
From the above Table provides inference that the ability of prediction for model was articulated by R value 0.594 and R^2value 0.353 which shows 35.3% of variance exist in the dependent variable is from the independent variables. F-value is 86.396 showing that there exists a relationship between PWE, Machines, Task, PSF with Resilience

Table-5 ANOVA- Physical workplace environment, Machines, Task, Psychosocial factor and Resilience

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	36.77	4	9.192	86.396	.000ᵇ
	Residual	67.35	633	0.106		
	Total	104.12	637			
a. Dependent Variable: Resilience						
b. Predictors: (Constant), PSF, PWE, Machines, TASK						

Source: Primary Data

Table-6 Coefficients- Physical workplace environment, Machines, Task, Psychosocial factor and Resilience

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.458	.207		11.899	.000
PWE	.304	.069	.241	4.394	.000
Machines	-.133	.043	-.136	-3.084	.002
TASK	.315	.035	.478	9.007	.000
PSF	-.025	.025	-.033	-.995	.320
a. Dependent Variable: Resilience					

Source: Primary Data
From the above table it is inferred that the beta value is 0.315 for variable 1 (Task) 0.304 for variable 2 (Physical workplace environment) and -0.133 for variable 3 (Machine) and -0.025 for variable 4 (Psychosocial factors) There is a significant relationship between Physical workplace environment and Resilience (P value = .000). There is a significant relationship between Machines and Resilience (P value = .002). There is a significant relationship between Task and resilience (P value = .000). Which is <0.05. There is no significant relationship found Psychosocial factors and Resilience since the P value is >0.05 Which is .320. Thereby the final regression equation is derived by the incorporating the coefficients as follows

> Resilience=2.458+**.315(Task) +.304(Physical workplace environment) -.133 (Machine) -** .025 Psychosocial factors.

H₃: Objective well-being does not depend on Physical workplace environment, Machines, Task, Psychosocial factor, Organizational ergonomics, Resilience.

The third hypothesis, the dependent variable is Subjective Well-being on the independent variables are Physical workplace environment(X_1), Machines(X_2), Task(X_3), Psychosocial factor(X_4) Organisational Ergonomics(X_5), Resilience(X_6).

$Y_3 = C_3 + A_{3a}X_1 + A_{3b}X_2 + A_{3c}X_3 + A_{3d}X_4 + A_{3e}X_5 + A_{3f}X_5$

Where c_3 is constant, A_{2a}, A_{2b}, A_{2c}, A_{2d}, A_{2e}, A_{2f} are regression coefficients. Thus the regression coefficients were executed.

Table-7 Model summary- Physical workplace environment, Machines, Task, Psychosocial factor, Organisational ergonomics, Resilience and Subjective well-being

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.501[a]	.591	.582	3.83329
a. Predictors: (Constant), RE, PSF, Machines, OE, PWE, TASK				

Source: Primary Data From the above Table provides inference that the ability of prediction for model was articulated by R value 0.501 and R^2value 0.591 which shows 59.1% of variance exist in the dependent variable is from the independent variables. F- value is 10.502 showing that there exists a relationship between PWE, Machines, Task, PSF, Organisational Ergonomics, Resilience with Objective Well-Being.

Table-8 ANOVA - Physical workplace environment, Machines, Task, Psychosocial factor, Organisational ergonomics, Resilience and Subjective well-being

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	925.871	6	154.312	10.502	.000[b]
	Residual	9271.967	631	14.694		
	Total	10197.839	637			
a. Dependent Variable: Objective Well-Being						
b. Predictors: (Constant), RE, PSF, Machines, OE, PWE, TASK						

Table-9 Coefficients - Physical workplace environment, Machines, Task, Psychosocial factor, Organisational ergonomics, Resilience and Subjective well-being

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	35.102	2.804		12.517	.000
PWE	.786	.834	.223	3.341	.001
Machines	-1.048	.525	-.108	-1.997	.046
TASK	.405	.436	-.108	-1.615	.007
PSF	-.692	.307	-.094	-2.251	.025
OE	.230	.458	.225	4.874	.000
RE	-.618	.473	-.062	-1.305	.192
a. Dependent Variable: Objective Well-Being					

Source: Primary Data

From the above table it is inferred that the beta value is 0.405 for variable 1 (Task) 0.786 for variable2 (Physical workplace environment) and .230 for variable 3 (Organisational Ergonomics) -1.048 for variable 4 (Machine) and -0.692 for variable 5 (Psychosocial factors) and -.618 for variable 6 (Resilience). There is a significant relationship between Physical workplace environment and Objective Well-Being (P value = .001). There is a significant relationship between Machines and Objective Well-being (P value = .046). There is a significant relationship between Task and Objective Well-being (P value = .007). There is a significant relationship between Psychosocial factors and Objective Well-being (P value = .025). There is a significant relationship between Organisational Ergonomics and Objective Well-being (P value = .000). Which is <0.05. There is no significant relationship found Resilience and Objective Well-being since the P value is >0.05 which is .192. Thereby the final regression equation is derived by the incorporating the coefficients as follows

Objective Well-Being=35.102+.786(Physical workplace environment) –1.048 (Machines) +.405(Task) - .692 Psychosocial factors +.230(Organisational ergonomics) - .618(Resilience).

Psychosocial factor, Organizational ergonomics, Resilience.

The Fourth hypothesis, the dependent variable is Objective Well-being on the independent variables are Physical workplace environment(X_1), Machines(X_2), Task(X_3), Psychosocial factor(X_4) Organisational Ergonomics(X_5), Resilience(X_6).

$Y_4 = C_4+A_{4a}X_1+A_{4b}X_2+A_{4c}X_3+A_{4d}X_4+ A_{4e}X_5+A_{4f}X_5$

Where c_4 is constant, A_{4a}, A_{4b}, A_{4c}, A_{4d}, A_{4e}, A_{4f} are regression coefficients. Thus the regression coefficients were executed.

Table-10 Model summary - Physical workplace environment, Machines, Task, Psychosocial factor, Organisational ergonomics, Resilience and objective well-being

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.351[a]	.463	.454	9.32853
a. Predictors: (Constant), RE, PSF, Machines, OE, PWE, Task				

Source: Primary Data From the above Table provides inference that the ability of prediction for model was articulated by R value 0.351 and R^2value 0.463 which shows 46.3% of variance exist in the dependent variable is from the independent variables. F- value is 7.056 showing that there exists a relationship between PWE, Machines, Task, PSF, Organisational Ergonomics, Resilience with Subjective Well- Being.

Table-11 ANOVA - Physical workplace environment, Machines, Task, Psychosocial factor, Organisational ergonomics, Resilience and objective well-being

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3684.054	6	614.009	7.056	.000b
	Residual	54910.498	631	87.021		
	Total	58594.552	637			
a. Dependent Variable: Subjective Well-Being						
b. Predictors: (Constant), RE, PSF, Machines, OE, PWE, TASK						

Source: Primary Data

Table-12 Co-efficients - Physical workplace environment, Machines, Task, Psychosocial factor, Organisational ergonomics, Resilience and objective well-being

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	62.275	6.825		9.125	.000
PWE	.694	2.029	.290	4.284	.000
Machines	-.359	1.277	-.015	-.281	.049
TASK	.608	1.062	.039	.573	.167
PSF	.126	.748	.007	.168	.066
OE	.353	1.114	-.057	-1.215	.005
RE	-.208	1.152	-.135	-2.785	.006
a. Dependent Variable: Subjective Well-Being					

Source: Primary Data

From the above table 4.38 it is inferred that the beta value is 0.694 for variable 1 (Physical workplace environment) and 0.608 for variable 2 (Task) .353 for variable 3 (Organisational Ergonomics) and .126 for variable 4 (Psychosocial factors) -.359 for variable 5 (Machine) and -.208 for variable 6 (Resilience). There is a significant relationship between Physical workplace environment and Objective Well-Being (P value = .000). There is a significant relationship between Machines and Objective Well-being (P value = .049). There is a significant relationship between Organisational Ergonomics and Subjective Well-being (P value = .000). Which is <0.05. There is no significant relationship found Resilience and Objective Well-being (.006). There is no significant relationship found Task and Subjective Well-being (P value = .167). There is no significant relationship found Psychosocial factors and Subjective Well-being (P value = .066). Since the P value is >0.05. Thereby the final regression equation is derived by the incorporating the coefficients as follows

Subjective Well-Being=62.275+**.694 (Physical workplace environment)** -.359 (Machines) +.608 (Task) +.126 Psychosocial factors +.353(Organisational ergonomics) -.208(Resilience).

Psychosocial Factor but doesn't have an effect on Task. Most of the employees strongly agree that Fire precaution is operational and accessibility is high. It shows that the companies are following fire safety measures. Resilience significantly depends upon Physical workplace environment, Machines, Task, but doesn't have an effect of psychosocial factor. Objective Well-being strongly depends upon Physical workplace environment, Machines, Organizational Ergonomics but not depend on Task, psychosocial factor Resilience. Subjective Well-being strongly depends upon Physical workplace environment, Machines, Task, psychosocial factor, Organizational Ergonomics and Resilience.

Table-13 Overview of Multiple Regression Analysis Results

Dependent variable	Independent Variable	PWE	MA	TA	PSF	OE	RE	SWB	OWB
OE	PWE MA TA PSF	S	S	NS	S	-	-	-	-
RE	PWE MA TA PSF	S	S	S	NS	-	-	-	-
SWB	PWE MA TA PSF OE RE	S	S	S	S	S	S	-	-
OWB	PWE MA TA PSF OE RE	S	S	NS	NS	S	NS	-	-

Source: Primary Data

PWE-Physical Workplace Environment, MA- Machines, TA- Task, OE- Organizational Ergonomics, Re- Resilience, SWB- Subjective Well-being, OWB- Objective Well-being.

IV. CONCLUSION

Today individuals turned out to be increasingly thoughtful about the comfort of wearing and furthermore the toughness of the garment. In a day, one needs various wears at various occasions. The garment industry is gaining lots of importance at Tiruppur where most of them are export oriented.

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The employees are working for long hours in same position, doing the same task at their workplace which involves lots of machines where the alignment between man and machine plays a predominant role and has termed as human engineering. The physical workplace environment and machines plays a major role in this study as these variables are leading to Organizational Ergonomics, resilience, subjective well-being and objective well-being. Workplace environment also plays a vital role in motivating employees to perform their assigned work (Chandrasekar (2011)). The workplace environments as per the present study are temperature, noise, vibration, lighting, prevention of chemical hazards, and prevention of fire hazards. Though all these factors are probed in by factories act and other legal compliance, this study has opened up new a dialogue which is part of employee welfare measures. Way back in Hawthorne experiments this sort of research has been carried out but the human engineering concept has proved employee well-being, which is beyond employee welfare and legal compliance . Indeed this human engineering approach facilitated employees for retention in the same workplace.

Modernization has created different tools and techniques at such workplace for expanding the profitability and productivity. Good condition, periodical maintenance, appropriate tools, precise work space, protective tools, appropriate specification, safety precautions user friendly machines creates better comfort and safety which leads to employee well-being. Task factor is an image creation of garment industry workers which does not impact on Organizational Ergonomics and Well-being. This study result shows that subjective well-being strongly depends on physical workplace environment, Machines, Task, Psychosocial factors, Organisational ergonomics and Resilience (human engineering factors). Subjective well-being is a person's cognitive and affective evaluations of his or her life, whereas objective well-being is defined in terms of quality of life pointers such as material resources (e.g. income, food, housing) and social attributes (education, health, political voice, social networks and connections).

The advantages of making and keeping up a positive workplace environment enhances Greater productivity, happier people, employee stability, business advantage, higher returns, better security, and better well-being (Shrestha, 2007). Hence we conclude that, Human Engineering factors (Physical workplace environment, Machines, Task, and Psychosocial Factor) facilitated by organisational ergonomics leads to a better employee well-being. Limitations of this study are Temperature level, Noise level, and Cotton dust concentrations at workplace Environment were not measured with equipment's. Gender based Employee Well-being can be measured which is future scope of further study. This finding again challenges Maslow hierarchy theory .

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